Circulation: Cardiovascular Imaging

RESEARCH LETTER

Deranged Lung Perfusion Pattern in Patients With Heart Failure Normalizes After Heart Transplantation

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Heart transplantation is the ultimate treatment for patients with end-stage heart failure (HF). Patients with severe HF have pulmonary congestion, which affects the pulmonary perfusion distribution. Invasive right heart catheterization (RHC) and echocardiography are routinely used to follow-up patients after heart transplantation. Furthermore, measurement of pulmonary artery wedge pressure (PAWP) from RHC is the gold standard for diagnosing pulmonary congestion. However, catheterization is invasive, and echocardiography is user dependent. Therefore, a noninvasive quantitative and user-independent method in the assessment of patients after heart transplantation would be of value. Ventilation/perfusion single-photon emission computed tomography (V/P SPECT) has previously been validated against PAWP from RHC in patients with HF.[1] This method enables both a qualitative and quantitative assessment of pulmonary perfusion pattern and thereby allows a more accurate diagnosis of pulmonary congestion than the recommended chest radiograph.[1] V/P SPECT has previously been used to assess treatment effect of anticongestive medication on patients with HF.[2] However, no previous study has investigated whether V/P SPECT could be used to assess treatment effect after heart transplantation. Our aim was to investigate whether V/P SPECT can be used to assess treatment effect after heart transplantation using RHC as the reference method.

Twenty-three patients with severe HF (52±8 years, 6 women, New York Heart Association classification II–IV, body mass index of 26±3) were prospectively included. The study was approved by the Ethical Board at Lund University, Sweden, and the patients gave informed consent. The patients underwent V/P SPECT and RHC before and 2 months (1 of 23 patients), 6 months (18 of 23 patients), or 1 year (4 of 23 patients) after heart transplantation. Before transplantation, the time span between both examinations was <6 days (18 of 23 patients), 13 days (1 of 23 patients), 2 months (3 of 23 patients), and 6 months (1 of 23 patients). The time span after transplantation was <3 days (19 of 23 patients), 22 days (1 of 23 patients), and 3 months (3 of 23 patients).

Catheterization was performed according to clinical routine. A Swan-Ganz catheter was used to monitor the hemodynamic parameters. The V/P SPECT examination was performed according to the European guidelines[3] and as described previously.[1,4] The distribution of pulmonary ventilation and perfusion was assessed using radioactive isotopes. Quantitative perfusion gradients were automatically derived from the perfusion SPECT images using an algorithm developed[2] and validated previously.[1] The data that support the findings of this study are available from the corresponding author upon reasonable request. A significant improvement in both the perfusion gradients from V/P SPECT (before transplantation, 1.08±2.87%-counts/cm; after transplantation, –2.11±2.35%-counts/cm; $P<0.001$) and the PAWP from RHC (before, 20±8 mm Hg; after, 9±5 mm Hg; $P<0.001$), tested using Paired *t* test, is shown in the Figure (A and B). The patient who did not

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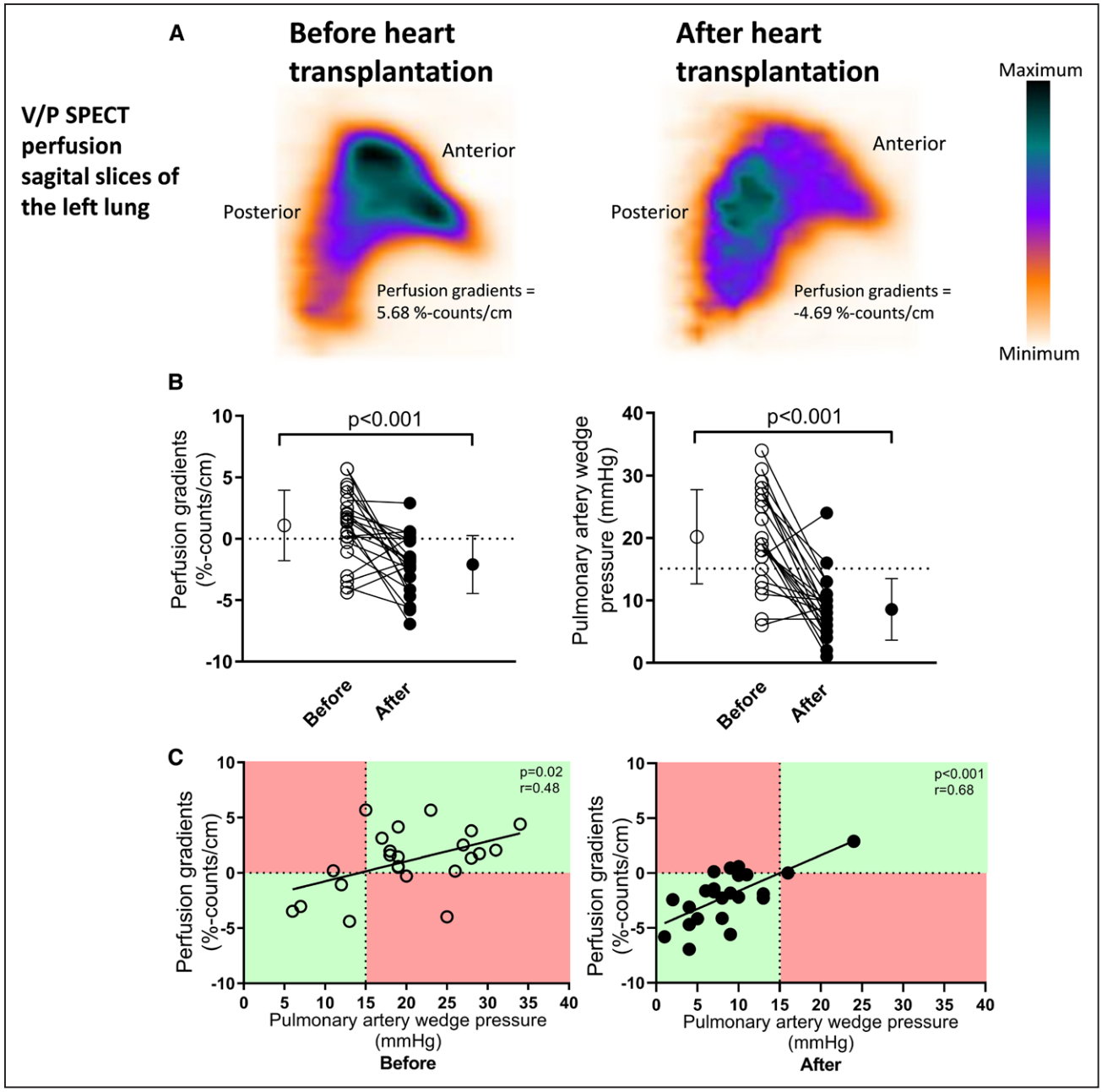

Figure. Ventilation/perfusion single-photon emission computed tomography (V/P SPECT) and pulmonary artery wedge pressure (PAWP) before and after heart transplantation.

A, V/P SPECT before and after heart transplantation, where V/P SPECT perfusion gradients and PAWP decrease significantly after heart transplantation (**B**). Error bars represent mean±SD. **C**, Correlation (Pearson) between perfusion gradients and PAWP before (open circles) and after (filled circles) heart transplantation. Both regression lines cut close to the cutoff values of 0%-counts/cm for perfusion gradients[1,2] and >15 mm Hg for PAWP,[5] respectively. The majority of patients are correctly characterized as having an increased or normalized left atrial pressure (green fields). The Cohen κ between PAWP and perfusion gradients was 0.65.

improve in perfusion gradients also did not improve in PAWP. There was a statistically significant correlation between perfusion gradients and PAWP (Figure [C]) where a clear discrimination can be made between normal and abnormal results.

These results show that V/P SPECT is a promising method for objective assessment and quantification of treatment effects in patients with HF after heart transplantation. Although V/P SPECT cannot replace RHC, it could be a noninvasive and useful method in selected cases to guide treatment and catheterization during follow-up. V/P SPECT could also be a user-independent tool to quantitatively evaluate results of anticongestive treatment in clinical trials.

ARTICLE INFORMATION

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Disclosures

None.

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